## RAINFALL AND GRAZING.

According to Mr. A. B. Wollaber, in the January Report of the Oregon Section, a careful estimate has been made in Australia on the relation of rainfall to the number of sheep capable of obtaining sustenance on a square mile of semiarid land. Up to a rainfall of 10 inches per annum, as many sheep can thrive on a square mile as there are inches of rainfall. When the rainfall is above 10 inches the ratio rapidly increases so that twenty sheep per square mile can be supported when the rainfall is 13 inches per annum and about seventy sheep when the rainfall is 20 inches per annum.

## THE FIRST NUMBER OF THE MONTHLY WEATHER REVIEW.

Some bibliographers may have noticed in the list of Weather Bureau publications a statement to the effect that MONTHLY WEATHER REVIEWS have been published since July, 1872. The more precise statement is that the publication began with the REVIEW for 1873, since which time it has appeared regularly and been very widely distributed. The first copy and the initial steps toward the regular publication were taken by the present Editor, but subsequent numbers were prepared by various officials, alternately. The general rule was that the forecast official for the month prepared the REVIEW for that month, but, of course, as a variety of duties multiplied and the scope of the REVIEW increased, the work of the editor was often limited to a very general supervision of the work done by the clerks of the REVIEW room; the personality of the editor did not enter into the REVIEW quite as clearly as it has done during the past few years.

When the Annual Report for the fiscal year ending June 30, 1873, was being prepared (and such work was always done by one of the assistants of the Chief Signal Officer) it was considered desirable to insert a reprint of the MONTHLY WEATHER REVIEWS for the six months, January-June, and also similar REVIEWS for the preceding six months. These latter were prepared by Mr. Calver, who was the clerk in charge of the Farmers Weekly Bulletin. Three of them, viz., those for October, November, and December were completed in time for publication in the Annual Report; those for the three months, July, August, and September, 1872, were filed as manuscripts and remained unprinted until 1888, when they were printed for the purpose of binding up a few sets of the MONTHLY WEATHER REVIEW, for use in the Central Office and at the larger stations. It is, therefore, proper to say that the regular publication of the MONTHLY WEATHER REVIEW began with the number for January, 1873, and that the earlier numbers were written up and printed subsequently.

## BOMBARDMENT OF HAILSTORMS.

In reply to a query from the editor of the American Agriculturist, the Chief of Bureau has lately sent the following reply, which embodies the present state of our knowledge as to the value of cannonading as a means of preventing hail. This extract is printed for the general information of others:

You ask whether the Department of Agriculture is planning to make any test of the French method of bombarding the clouds to prevent hailstorms; if so, when and where and how many? What do you think of this idea, any way?

The method you speak of is undoubtedly based upon popular delusions, and has spread throughout Italy, southern Austria, and southern France. It is practised by the owners of vineyards, and is especially exploited by the firm of Greinitz, Neffen, manufacturers of iron works, Gratz, Austria. The inventor of the apparatus is Mr. Stiger, and the method is ordinarily spoken of as the Stiger method. It consists essentially in sending vortex rings of smoke and air upward toward the clouds; but the most powerful Stiger cannon that have yet been employed do not send these rings higher than 1,200 feet above the ground, and, therefore, utterly fail to reach the clouds. On this account the distinguished Austrian meteorologist, J. M. Pernter, has maintained that if there is any virtue whatever in the idea, the experimenters must use much more powerful apparatus. But there is no satisfactory evidence that the cannonading or the vortices had any influence whatever on the hail. Both theory and practise agree in this conclusion. Theoretically it was imagined by Mr. Stiger that hail is formed in quiet spots in the atmosphere where the atmospheric moisture could crystallize out in large crystals in a manner analogous to the formation of large crystals of salt in liquid solution. But this is a very foolish notion: there are no such quiet spots in the atmosphere, and hailstones are not crystals but masses of ice, with only a feeble or partial crystalline structure. Even the perfect crystals of the snowflakes are formed in the midst of rapidly-moving air, so that the whole theoretical basis for hailstorm cannonading falls to the ground.

It is generally difficult to prove that a specific fall of hail has been especially influenced by the cannonading. Hailstorms are generally very local and erratic; some have maintained that they are controlled by the hills and contour of the ground or by the presence of forests and lakes, but practically the whole question is one of the ascending and descending currents of air that characterize whirlwinds and thunderstorms. If in the midst of these complex motions with the resulting rain there occur here and there patches of hail, it would seem absurd to say that we can put our finger upon the precise influence that caused or prevented hail. If in the midst of a hailstorm I fire off a cannon and the hail ceases to fall on my land but continues to fall on my neighbor's, it would be folly in me to maintain that this is due to the firing of my gun. Nothing but the continued repetition of this phenomenon, under a variety of circumstances, would justify such conclusions. Now, the fact is that in the various reports relative to hail shooting there has not been a fair presentation of the statistics of the results. Nothing is told us as to where the hailstorms come from or go to, nor even whether there were any hailstorms, but in most cases the record simply says that a threatening cloud was seen approaching, the cannonade began and continued until the cloud went away, and no hail fell on the region supposed to be protected by the cannon. But this is not all, the last congress on the bombardment of hail utterly refused to entertain reports from those who testified that the hail fell in spite of the cannonade. In fact, therefore, reports showing that in no case was the cannonading of any avail had to be published independently.

After examining all that has been published during the past two years, my conviction is that we have here to do with a popular delusion as remarkable as is the belief in the effect of the moon on the weather. The uneducated peasantry of Europe seem to be looking for something miraculous. They would rather believe in cannonading as a means of protection and spend on it abundance of money, time, and labor, than adopt the very simple expedient of mutual insurance against the losses that must inevitably occur.

After the experience this country has had during the past ten years to believe that the bombardment of hailstorms will ever be practised, or even attempted in the United States, much less encouraged by the with such rain-makers as Dyrenforth, Melbourne, and others, I am loath intelligent portion of the community. Every effort should be made to counteract the spread of the Italian delusion. which seems to have been imported into this country by the unfortunate publication of the reports of the United States consul at Lyon, France.

I trust that the columns of the American Agriculturist will discuss the subject with sufficient fulness to enable the farmers to see that the great processes going on in the atmosphere are conducted on too large a scale to warrant any man or nation in attempting to control them. The energy expended by nature in the production of a hailstorm, a tornado, or a rain storm, exceeds the combined energy of all the steam engines and explosives in the world. It is useless for mankind to combat nature on this scale. Fortunately, the destruction by hail, lightning, floods, etc., is usually confined to small regions.

## SAND DUNES AND THE WIND.

The piles of light sand along the coasts of the oceans and lakes are frequently driven forward by the wind, forming so-called dunes, which are in continual motion, traveling as fast as the wind can carry up the sand on the windward side and deposit it on the leeward side of the mound. This perpetual renewal of the windward and leeward surfaces prevents the growth of vegetation quite independently of the extreme dryness of the sand. Such dunes, either of sand or fine soil, have been encroaching on the Valley of the Nile from time

immemorial.. They are also found traveling over the valleys of the Euphrates and Tigris, covering up the cities and the civilization of Assyria and Babylonia. Along the coast of Denmark, many parts of England and southwestern France, the Atlantic coast of Long Island and North Carolina, and on the shores of Lakes Michigan and Erie, such dunes are well known. In order to diminish their steady motion the most successful method has been to set out, or sow the seeds of grasses with very long roots. As this grass spreads rapidly and every joint that is buried becomes a new center for roots, it soon makes a protective covering and checks the moving sand. The movement of sand dunes as modified by wind and rain and frost would form an excellent subject for exact investigation by some observer.

## THE GLACIER AS AN INDEX OF CLIMATE.

In the search for natural phenomena that sum up the total effect of the seasons from year to year, meteorologists have sometimes used the statistics of the condition of the glaciers, just as the botanists have been accustomed to use the statistics of the annual rings of growth of trees. If a glacier is increasing in volume year by year, this is considered as an evidence that the quantity of snow and, therefore, the cold is increasing, or the quantity of heat is diminishing. But a glacier is the result of complex conditions; it may easily happen that on one side of a mountain range the glaciers are increasing, while on the opposite side they are simultaneously decreasing. The growth of a glacier is favored by the fall of snow, sleet, and hail and by the prevalence of cool, cloudy weather, and these conditions depend quite as much on the direction of the wind as on the temperature. Those who look to the glaciers to tell them whether, at the present time, the climate is becoming colder or warmer, will be interested in the statement taken from Nature of April 4, 1901, p. 547, to the effect that the survey of Swiss glaciers made since 1897 shows that out of fifty-six cases thirty-nine are diminishing in size, five are stationary, and twelve are increasing. These three classes represent the three types of locations in which, during these past few years, local conditions have been, respectively, favorable or unfavorable to the growth of a glacier. As they stand they tell us very little as to whether the general climatic conditions are more or less favorable to glaciers than formerly, and, indeed, nothing as to whether temperature, snowfall, or rain has produced the variations in the glacier.

## AN OLD RECORD AT PENSACOLA, FLA.

In the first volume of the transactions of the American Philosophical Society of Philadelphia is a very interesting letter from Dr. J. Lorimer, of Pensacola, "West Florida," from which it appears that about 1768 he kept a record of his Fahrenheit thermometer three times a day for a whole year. The Editor is very desirous of obtaining some clew to this ancient temperature record. Dr. Lorimer states that his extremes range between 17° and 98° F.

It is greatly to be hoped that his manuscript record has escaped the ravages of time. As he was then surgeon to the British troops at this station it is possible that his record is still preserved in the British archives in London.

## THE KITE WORK OF THE GERMAN ANTARCTIC EXPEDITION.

We have received information to the effect that the German South Polar Expedition will systematically make kite ascensions in the trade winds from aboard ship during the southward journey, and continue the work in the antarctic regions.

The expedition is fully equipped with aerial apparatus, all substantially of the Weather Bureau pattern, and the scheme will be that followed at Washington, with modifications required by the conditions and resulting from extensive experiments with the Weather Bureau outfit at the Deutsche Seewarte.

The kites are of three sizes, the large Marvin, like those used by the Weather Bureau of 6½ square meters surface, Hargrave kites of 4 and 2¾ square meters surface, and light Eddy kites of 2¾ square meters, which are very advantageously employed in lifting and sustaining the larger kites with the instruments in light winds.

This appears to be the first occasion on which preparations have been made for the systematic exploration of the upper air conditions in the polar regions.

During the cruise of the U. S. S. *Pensacola* to Africa and back, October, 1889–May, 1890, the editor attempted to measure the actual linear velocity of the winds at sea by the observation of small balloons filled with hydrogen gas. These were set free from the stern of the vessel, and it was expected they would rise and be carried by the free wind in such a direction as to be easily observed with the sextant. Curiously enough, however, as the vessel was under sail these balloons became entangled in the currents about the sails, and we were never able to get a single satisfactory observation. Balloons of very considerable size would be necessary in order to free themselves from the disturbances produced by the sails. We very much hope that better fortune awaits the kite experiments on board of the German vessels.

## AVERAGE TEMPERATURE OF UPPER STRATA.

According to Ciel et Terre, May 1, 1901, p. 130, and the Paris Comptes Rendus, November 26, 1900, p. 920, Monsieur L. Teisserenc de Bort has deduced from 240 ascensions of sounding balloons in 1898, 1899, and 1900, at the Meteorological Observatory at Trappes, the results given in the following table, showing the monthly mean temperatures at Paris and in the atmosphere above it:

| Month. | Monthly mean temperatures. | | | Total diminution. | |
|---|---|---|---|---|---|
| | On the ground. | 5,000 meters. | 10,000 meters. | 5,000 meters | 10,000 meters. |
| | ° | ° | ° | ° | ° |
| January | 5.4 | —15.3 | —47.6 | 20.7 | 53 0 |
| February | 1.0 | —21.8 | —53.4 | 22.8 | 54.4 |
| March | 0.9 | —30.9 | —53.7 | 21.8 | 54 6 |
| April | 5.8 | —18.4 | —49.3 | 23.7 | 54.6 |
| May | 7.0 | —16.8 | —51.3 | 23.8 | 58.3 |
| June | 14.2 | — 8.8 | —45.3 | 23.0 | 59.5 |
| July | 15.7 | — 8.7 | —44.5 | 24.4 | 60.2 |
| August | 17.8 | — 7.2 | —41 8 | 25.0 | 59.6 |
| September | 13.4 | — 9.7 | —47.9 | 23.1 | 61.3 |
| October | 10.2 | —11.0 | —45.1 | 21.2 | 55 3 |
| November | 3.8 | —12.8 | —45.2 | 16 6 | 49.0 |
| December | 0.9 | —18.9 | —52.4 | 19.8 | 53.3 |

From these figures, which are apparently much more reliable than those given on page 415 of the MONTHLY WEATHER REVIEW for September, 1899, Monsieur Teisserenc de Bort draws the following conclusions:

(1) At 10,000 meters altitude the temperature has a decided annual variation. (The range of monthly means is 11.9, as compared with 16.9 at the earth's surface.)

(2) The amplitude of the annual variation diminishes with altitude.